Hand-Assisted Laparoscopy in Urology

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Hand-assisted laparoscopy (HAL) allows surgeons direct hand contact with the operative field, maximizing tactile feedback and minimizing surgical injury to the patient. Indications for HAL include radical, donor, and partial nephrectomies, nephroureterectomy, and, most recently, dismembered pyeloplasties. The advantages of HAL surgical techniques in comparative experience with standard laparoscopic technique are described. [Rev Urol. 2001;3(2):63–71]

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Hand-assisted laparoscopy (HAL) utilizes all the principles of standard transperitoneal laparoscopy. A pneumoperitoneum is created to insufflate the abdomen, increasing the working space. A laparoscope is introduced to provide magnified visualization of the operative field, and laparoscopic instruments are utilized to perform the surgery. The only difference between standard laparoscopy and HAL is that the surgeons are also able to introduce their hand into the operative field.

This technique has allowed the laparoscopist to maintain use of the most versatile instrument available, the surgeon's hand, for exposing, retracting, dissecting, and maintaining hemostasis. The hand may assist in more advanced laparoscopic techniques such as intracorporeal suturing and knot tying. Furthermore, by maintaining the tactile sense, the surgeon is able to palpate vessels and adjacent organs minimizing the chance of injury to vital structures, particularly during difficult laparoscopy dissections. In essence HAL combines the advantages of laparoscopy and open surgery. As has been said by Dr. R.V. Clayman, "one hand is worth a thousand trocars" (Ramon Guiteras Lecture, American Urologic Association Annual Convention 2000).

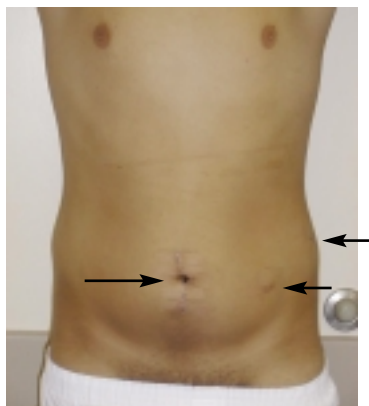Visit www.medreviews.com to view a video of this procedure.

Figure 1. *2 weeks post-HAL scar.*

The hand may be introduced through variously placed incisions in the anterior abdominal wall, depending upon the procedure to be performed and the surgeon's preference. We prefer to place all of our hand device incisions at or below the umbilicus. In addition, when intact extirpation of a specimen is required, the incision used to introduce the hand is the same in which the specimen is retrieved. Removing an intact radical nephrectomy specimen following standard laparoscopy requires a 5 to 6 cm incision. Performing a HAL radical nephrectomy with intact removal in a surgeon with size 8 gloves requires a 7 cm incision (Figure 1).

Several devices allow the hand to be introduced into an insufflated abdomen while maintaining the pneumoperitoneum (see Figure 2A-C).

The first device, introduced in 1997, was the Pneumosleeve (Dexterity, Atlanta, GA). Because the Pneumosleeve was the first device available, it has had the most extensive use among surgeons. An adhesive plate is attached to the insufflated abdominal wall, an incision is created, and the surgeon's hand is introduced into the abdomen. The surgeon wears a sleeve with a locking mechanism that seals to the undersurface of the plate, providing an airtight seal that allows the pneumoperitoneum to be maintained. Two other devices have been recently introduced: the Intromit (Applied Medical, Rancho Santa Margarita) and the Handport (Smith Nephew, Andover, MA). The Intromit is a one-piece device, which also requires an adhesive to fix it to the anterior abdominal wall. No sleeve is required, and the device can be placed without a pneumoperitoneum. The Handport does not use adhesives, requires the surgeon to wear a sleeve, and maintains the pneumoperitoneum by insufflation of the device itself.

All of the devices are effective, and selection depends on surgeon preference, location of hand incision, body habitus, and patient's history of prior abdominal surgery. For example, a patient with a history of abdominal surgery may benefit from having the hand incision made at the onset of the case to aid with lysis of adhesions. In that scenario, a device

that does not require a pneumoperitoneum to be placed may be preferable. In patients in whom a low Pfannenistiel incision is to be used, a device that does not have an intrabdominal component may prove beneficial. To better elucidate these differences and objectively evaluate the 3 devices, we are in the process of performing a prospective randomized trial using all 3.

Indications for HAL

Laparoscopists in general surgery and gynecology have already embraced hand-assisted laparoscopic surgery. This technique is being utilized for colon resections, splenectomy, hysterectomy, distal pancreatectomy, partial hepatectomy and other complex laparoscopic procedures.[1-4] In urology, HAL was first introduced in 1996 when Bannenberg et al. performed the first HAL nephrectomy in the pig.[5] They reported that hand-assisted laparoscopic nephrectomy was quick and easy to perform, and compared with conventional laparoscopic nephrectomy, operative times were much shorter (30 to 45 minutes versus 90 to 120 minutes).[5] In 1997 Nakada and colleagues performed the first hand-assisted laparoscopic nephrectomy in a human for a chronically infected kidney from stone disease.[6]

Since 1997 many investigators have reported their experience with

Figure 2 A,B,C. *Schematic of all three hand devices. A) Pneumosleeve, B) Handport, C) Intromit*
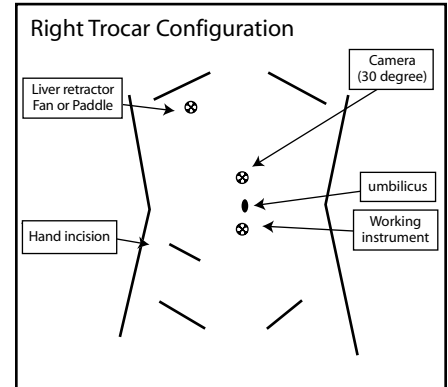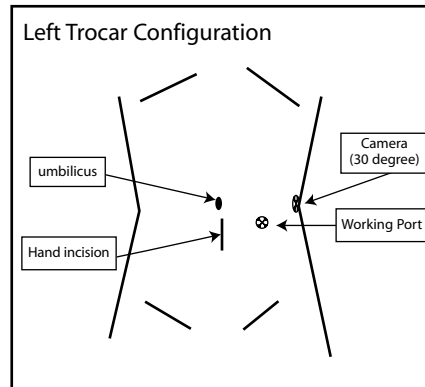
Figure 3. *Patient positioning.*

Figure 4A,B. *Port position.*

HAL to perform complex laparoscopic urologic procedures including radical nephrectomies, nephroureterectomies, donor nephrectomies, partial nephrectomies, and most recently, dismembered pyeloplasties.[7-12]

Technique

The patient is placed in the semilateral decubitus position using slight table flexion. A neural arm board is utilized to support the most anterior arm and 3-inch cloth tape secures the patient to the table (Figure 3). This allows the patient to be rotated both away and toward the surgeon as necessary. The port configuration we prefer for both left- and right-sided surgery is illustrated in Figure 4A,B. The figure assumes the surgeon is right-handed. For a left-handed surgeon, use the mirror of the right-sided configuration for a left nephrectomy and vice-versa. The non-dominant hand is placed into the operative field and the dominant hand is used to work the laparoscopic instruments. An assistant or robotic arm works the laparoscope. The configuration we choose allows the hand to easily access the renal hilum while maintaining full mobility of the wrist and avoiding interference with the laparoscope and/or laparoscopic instruments.

Universal to all HAL renal surgery is the need to first gain access to the retroperitoneal space. For the left side, the colon is reflected medially by sharply incising the line of Toldt from the iliac vessels to the splenic flexure. The nondominant hand reflects the colon medially. The fingertips help reflect the mesocolon off the anterior aspect of Gerota's fascia and electrocautery shears or the harmonic scalpel are used for dissection (Figure 5). The dissection is carried in a cephalad direction, freeing the lateral splenic attachments from the diaphragm to the level of the gastric fundus. The splenorenal attachments are released, allowing the entire spleen to fall medially with gravity alone.

The plane between the tail of the pancreas and Gerota's fascia is developed, allowing the tail of the pancreas to rotate medially with the spleen and splenic flexure. Gerota's fascia is now exposed and freed from all anterior attachments. The superior/anterior aspect of the adrenal gland and renal hilum will now be exposed.

Using the back of the hand to
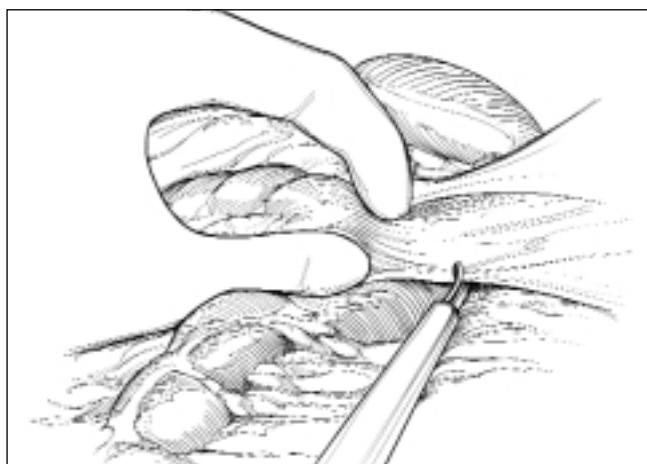
Figure 5 A,B. *Reflecting colon.*

Figure 6. *Renal vein exposure.*

Figure 7. *Posterior approach to hilum.*

retract the mesocolon medially the anterior renal hilum is dissected using the first three digits of the nondominant hand and the harmonic scalpel, Maryland dissector, and electrocautery shears (See Figure 6). The gonadal and/or adrenal veins are clipped and divided. With this complete, no further dissection should be performed on the renal hilum at this point in the procedure.

For the right side, the right lobe of the liver is released from the body sidewall by incising the triangular ligament. The anterior and posterior divisions of the coronary ligaments are divided to allow the liver to be retracted more medially exposing the upper aspect of Gerota's fascia. A liver retractor placed through the right upper quadrant port is needed

to hold the liver anterior/ medially. The colon and hepatic flexure are mobilized medially. The duodenum is identified. A standard Kocher maneuver is performed using sharp and blunt dissection exposing the vena cava and renal hilum.

The procedure to be performed dictates the next step. For a donor nephrectomy, the ureter is identified and isolated below the lower pole. All attachments on the medial aspect of the ureter are freed from the level of the renal hilum caudal to the iliac vessels. Lateral attachments of the ureter are freed from the lower pole of the kidney caudal to the iliac vessels. This creates a triangle at the lower pole made up of Gerota's and ureteral vascular supply. Next, Gerota's fascia is incised and the

perinephric fat is removed from the kidney circumferentially being careful to leave the perihilar fat intact. The adrenal gland is removed from the superior medial aspect of the kidney using the harmonic scalpel. At this point, the kidney is grasped with the thumb posteriorly and palm anteriorly and rolled anteromedially. This allows the surgeon to dissect the renal vessels from a posterior approach similar to the open technique (Figure 7). Throughout the hilar dissection it may prove beneficial at certain times to place the kidney back into its anatomic position and approach aspects of the hilum anteriorly. The renal hilar dissection is complete when both renal vein and artery are skeletanized to the IVC and aorta respectively. Once the hilar dissection is complete and the kidney completely freed circumferentially the ureter is clipped and divided below the level of the iliac vessels. The artery is secured with either an endoscopic linear stapling device or clips. The vein is divided with an endoscopic linear stapling device (Figure 8). The kidney is immediately handed to the recipient team for preparation.

For a radical nephrectomy or nephroureterectomy, once the anterior renal vein has been isolated, attention

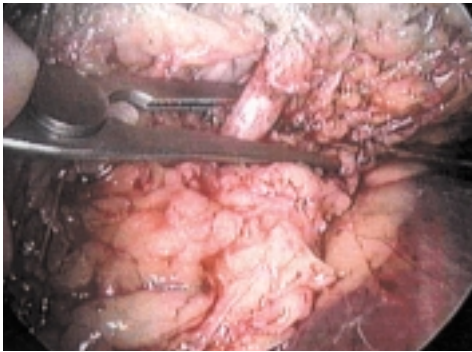Figure 8 A,B. *Renal artery and vein being controlled.*
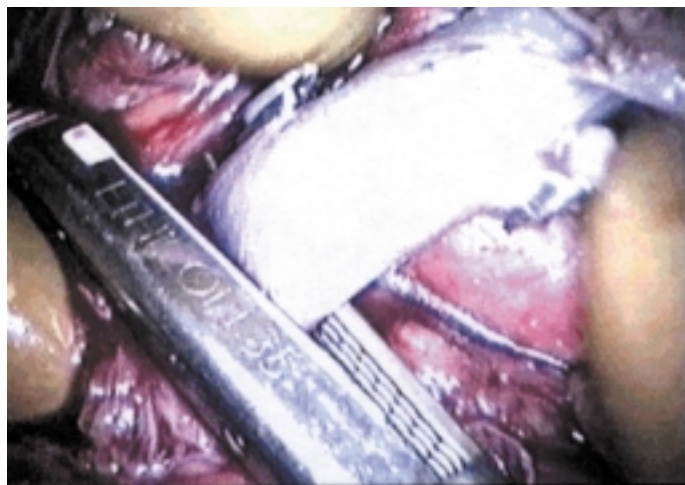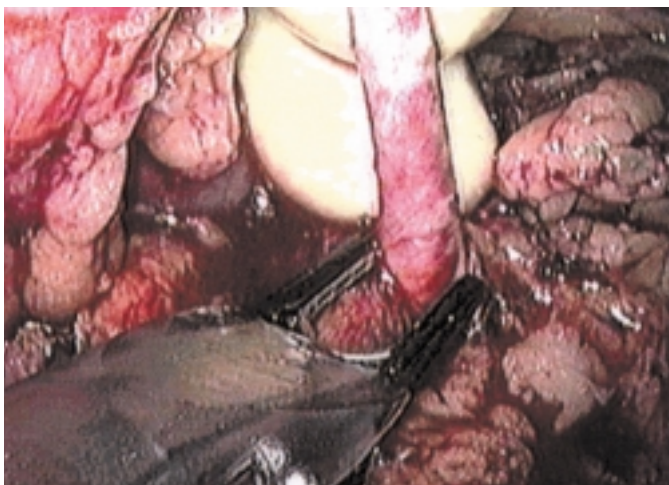
Figure 9. *Arterial occlusion with Bull Dog.*

Figure 10. *Scoring of capsule prior to partial nephrectomy.*

is paid to releasing all attachments to the lower pole. This is accomplished with either a harmonic scalpel or endoscopic linear stapler. For a radical nephrectomy, the ureter can be divided at this level between clips, in contrast to a nephroureterectomy where the ureter must be isolated and left intact. The remaining lateral and posterior attachments to Gerota's fascia are next divided using a harmonic scalpel. Similar to the technique described above for a donor nephrectomy, the kidney is rotated medially allowing for posterior dissection of the renal hilum. In contrast to a donor nephrectomy the vessels do not need to be dissected so proximally, and once adequate length on the vessel is obtained to place a clip or stapler, the vessel should be divided. At this point, the only remaining attachments to the kidney are situated superiorly. When the adrenal gland is to be left in place, the upper pole attachments may be dissected from the inferior aspect of the adrenal with clips and a harmonic

scalpel. If the lesion dictates that the adrenal gland is to be removed with the specimen, then the superior, medial, and posterior attachments of the adrenal are released using the harmonic scalpel and clips. For a radical nephrectomy, all remaining attachments should be freed and the specimen removed through the hand incision.

For a nephroureterectomy, once the distal ureter is freed to the level of the bladder, the intramural ureter and bladder cuff are freed endoscopically. This is performed in the dorso-lithotomy position and has been described in detail in previous publications.[11] The kidney, ureter, and bladder cuff are retrieved through the hand incision.

When a partial nephrectomy is to be performed, we recommend dissecting out the entire kidney as if performing a radical nephrectomy. This allows the surgeon to easily access the renal artery in case temporary occlusion is necessary and also allows the surgeon to perform an expedient radical nephrectomy if deemed necessary (see

Figure 9). We recommend using a laparoscopic ultrasound to confirm tumor depth and map out renal vasculature. When possible maintain Gerota's fascia on the capsule of the tumor. Score the renal capsule 5 mm from the tumor edge circumferentially with electrocautery (Figure 10). Next, a combination of the harmonic scalpel and argon beam laser coagulation is used to excise the lesion. The harmonic scalpel is set at level 3, and the lesion is excised approximately 2 to 3 mm at a time. The argon beam laser is then used to cauterize and maintain hemostasis (Figure 11A,B).

In all patients squeezing the kidney with the intra-abdominal hand just proximal to the resection site ensures temporary hemostasis (Figure 12). At this point, one of several methods may be utilized for proper hemostasis. Surgi-cell can be manually pressed into the renal defect. Three to four chromic plegit sutures are then placed to reapproximate the renal capsule. Gerota's fascia is now reap-

Figure 11 A,B. *Harmonic scalpel and argon beam laser coagulation.*

Figure 12. *Hand maintaining hemostatis during wedge resection.*

proximated over additional Surgicel to bolster the repair. Another equally effective technique has been described by Wolf et al.[12] Fibrin soaked gel foam is pressed into the defect. Thrombin spray is utilized to activate the fibrin and pressure placed for 10 minutes. Though hemostasis appears adequate with this latter method we recommend placing 2 to 3 sutures to reapproximate the renal capsule and Gerota's fascia (Figure 13A,B). A Jackson Pratt drain is left through the lateral trocar site, or separate lateral puncture.

We have recently begun performing pyeloplasties. Three patients had obstruction secondary to crossing vessels, and one patient had an obstructing fibroepithelial polyp. Exposure to the anterior retroperitoneal space is obtained as described above. Rather than mobilize the kidney, however, we identify and isolate the ureter just below the lower pole. Using a combination of blunt and sharp dissection the ureter, renal pelvis, and lower pole are dissected free. In cases of a vessel crossing, the ureter is freed completely to the level of the renal pelvis. The ureter is then transected at the level of the crossing vessel and positioned anteriorly to the vessels. A standard dismembered pyeloplasty is performed using interrupted 4.0 chromic. In the one patient with a fibroepithelial polyp, a ureterpyelotomy was performed, the polyp was excised, and the ureter and pelvis closed using 4.0 chromic. With the hand in the operative field, intracorporeal suturing and knot tying may be performed using either an instrument tie or two-handed tie as in open surgery.

There are definitive instances where we would not recommend using HAL as the primary modality. These include use in young children, deep pelvic surgery and during retroperitonoscopy. We find the hand in the operative field takes up too much working space, making visualization and exposure difficult. In addition, we prefer standard laparoscopy for performing all of our adrenalectomies and when performing simple nephrectomies for removal of small atrophic kidneys or hydronephrotic, non-functioning kidneys. HAL is an excellent option when one is going to perform extirpative surgery on a large organ requiring a relatively large extraction site. Also, HAL may prove beneficial in assisting the surgeons in complex laparoscopic procedures where vascular control and/or urinary reconstruction is paramount (i.e., partial nephrectomy, pyeloplasty, and ureteral reconstruction).

In terms of learning the technique, we recommend that all surgeons, except those with advanced laparoscopic training, take a postgraduate course and work on an animal model prior to attempting their first case. The American Urologic Association sponsors five 2-day courses throughout the year, and with the demand so great, is anticipated that this number will increase. Although HAL allows the surgeon a hand in the operative field, the technique relies heavily on advanced laparoscopic skills and instrumentation.

Results

From March 1998 to October 2000, we performed over 200 HAL nephrectomies. Early in our experience, we compared our HAL outcomes to a contemporary group of patients that underwent nephrectomy using the traditional open technique (OPEN). Specifically we evaluated patients

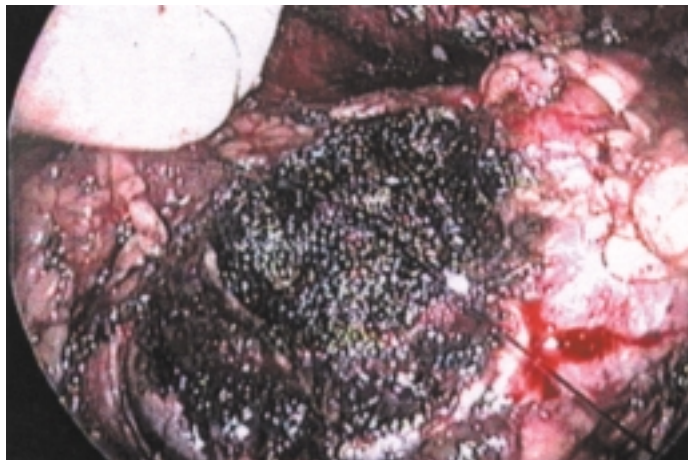Figure 13 A,B. *Renal capsule sutures for hemostatis.*

Table 1
HAL vs OPEN Renal Surgery

	Operative Time (min)	Estimated Blood Loss(cc)	Parenteral Narcotics (mg MS04)	Oral Narcotics (Tablets)	Length of Stay (days)	Comp. (%)	Convalescence (weeks)
Donor Nephrectomy							
HAL (n = 60)	240 ± 88.4	82.9 ± 61.8	35.5 ± 19.5	4.2 ± 4.3	3.7 ± 1.7	6 (10%)	4.0 ± 0.5
OPEN (n = 30)	265 ± 50.5	364 ± 449*	198 ± 57.7*	11.0 ± 4.5*	4.5 ± 1.2*	5 (15%)	9.2 ± 3.9*
Nephroureterectomy							
HAL (n = 22)	267 ± 61	180 ± 103	55 ± 39	5.8 ± 3.7	4.1 ± 7	1 (9%)	< 4 weeks
OPEN (n = 11)	232 ± 90	311 ± 117*	45 ± 16+	16 ± 9.8*	6.3 ± 1.9*	0 (0%)	> 6 weeks
Radical Nephrectomy							
HAL (n = 74)	198 ± 77	131 ± 66	32.8 ± 24.6	4.6 ± 3.3	3.7 ± 1.3	6 (8%)	< 4 weeks
OPEN (n = 20)	196 ± 37	372 ± 68*	208.5 ± 73*	8.8 ± 4.5*	5.2 ± 1.4*	2 (10%)	NR

$P < .05$
(OPEN patients required epidural for average 2.7 days; no patient received epidural in HAL group.)

undergoing nephroureterectomy, donor nephrectomy, and radical nephrectomy. Our results are summarized in Table 1. Operative time and complication rates are not statistically different between the HAL and OPEN groups. However, estimated blood loss (cc), parenteral narcotic requirements (milliequivalents of morphine sulfate), oral narcotic requirements (tablets), length of stay (days), and time of convalescence are all statistically less in the HAL group compared to the OPEN group. Wolf et al. have also compared their HAL experience with the traditional open technique, confirming these findings.[7]

Comparing our results with standard laparoscopic techniques, there appear to be no advantages that favor the standard laparoscopic technique. Table 2 summarizes our experience with HAL nephroureterectomy and donor nephrectomies compared with standard laparoscopic series.[13,14,16] Parenteral narcotic requirements (milliequivalents of morphine sulfate), oral narcotic requirements (tablets), length of stay (days), and time of convalescence are similar between the HAL and these standard laparoscopic series. However, average operative time was more than 3 hours faster in the HAL nephroureterectomy series compared with the standard laparoscopic series, and estimated blood loss was less in the HAL donor nephrectomy series compared with the standard laparoscopic donor series. These findings are not surprising considering that these procedures all require an extraction site. Thus, the only major difference between HAL and standard

laparoscopy is that the extraction incision is made at the start rather than the end of the case. As illustrated in Table 2 this distinction does not appear to affect patients' post-operative outcomes but does hasten operative time and provide better vascular control and hemostasis.

In terms of live donor nephrectomy recipients, allograft function and recipient complication rates are as important as donor outcomes when evaluating different donor nephrectomy techniques. Comparing our HAL experience with our OPEN experience, recipients do as well if not better using the HAL technique. Nadir creatinine, time-to-nadir creatinine, and creatinine clearance over time were similar between the HAL and OPEN groups. In terms of complications, the HAL group had fewer ureteral

Table 2
HAL vs Standard Laparoscopic Renal Surgery

	OR Time (min)	EBL (cc)	Ischemia Time (sec)	Major Complication	IV Narcotics (Milliequiv)	Length of Stay (days)	Return to work (weeks)
Donor Nephrectomy							
HAL (n = 60)	240 ± 88.4	82. ± 61.8	124	3 (5%)	35.5 ± 19.5	3.5 ± 0.7	4.0 ± 0.5
LAP (n = 110)[13,14]	232 ± 33	266 ± 174	NR	6 (3%)	40 ± 33	3.0 ± 0.9	4.0 ± 2.3
Nephroureterectomy							
HAL (n = 22)	272	180	NA	1	55	4.1	2.7
LAP (n = 25)[16]	462	199	NA	2 ± 9.8	37	6.1	2.8

Table 3 HAL vs OPEN Partial Nephrectomy	OR Time (Min)	EBL (cc)	Transfusion Rate (%)	Major Complication	IV Narcotics (Milliequiv)	Length of Stay (days)	Convalescence (weeks)
HAL Partial							
Stifelman et al. (n=11)	273 ± 91	319 ± 307	(0) 0%	0 (0%)	35.6 ± 18.9	3.3 ± 0.9	< 4*
Wolf et al. (n=10)[12]	199 ± 64	460 ± 525	(1) 10%	1 (10%)	40 ± 30	2.0 ± 1.1	1.2†
OPEN Partial NX[12]	161 ± 25	209 ± 155	(2) 18%	1 (10%)	105 ± 123	3.5 ± 1.1	3.3†
* Return to work. †Return to normal activity.							

complications, delayed graft function and fewer episodes of rejection within the first 3 months.[16] Though not statistically significant, possible explanations for these trends include better visualization with the laparoscope, decreased manipulation of the kidney using the hilar dissection techniques described above, and an immunologic benefit realized with the HAL technique.

In comparing our recipient outcomes using HAL-procured kidneys with standard laparoscopic techniques, certain distinct advantages seem to favor the HAL technique. Noguiera et al. recently reported on 132 recipients of laparoscopic procured live donor nephrectomies.[13] Their series noted that standard laparoscopic-procured kidneys had higher nadir creatinine and slower return to nadir in the first week compared with open-procured kidneys. At day 7, the average creatinine in the laparoscopic group was above 2.3 mg/dl compared with 1.83 mg/dl in the open group. In addition, the creatinine at 30 days posttransplant remained higher in the laparoscopic group.[2] Kavoussi et al. also noted a slower decline in creatinine in their laparoscopic group compared with their open cohort.[14] Though the long-term clinical significance is unclear, this phenomenon is not seen with the HAL technique.

In terms of ureteral complications and delayed graft function, HAL appears to have a decreased incidence of these occurrences compared with standard laparoscopic series. Noguiera reports a 7.6 incidence of delayed graft function (n =132) and Kavoussi reports a delayed graft function of 6.4% (n =110).[14,15] In our series of 60 HAL donor nephrectomies, only one recipient (1.6%) had an episode of delayed graft function. Our incidence of ureteral complication of 1.6%, compares favorably to other standard laparoscopic series that report incidences of 4.5% and 9.1%.[13,14] We believe the reason for the lower incidence of delayed graft function and ureteral complication is secondary to having the hand in the operative field. Allowing the surgeon tactile sensation and proprioception prevents unnecessary trauma to the renal hilum during dissection and permits a more gentle dissection of the ureter and kidney.

Our results on HAL partial nephrectomy have recently been reported at the World Congress of Endourology 2000 Annual Meeting. In addition Wolf et al. published their experience using HAL to perform partial nephrectomies.[12] Intraoperative and post-operative outcomes were similar between the two groups (Table 3). Convalescence data were reported using different definitions; however, both revealed favorable outcomes, with one group reporting an average return to normal activity of 1.2 weeks and the other group reporting an average time to return to work of less than 4 weeks. In neither group was there a positive margin or recurrence reported. Wolf et al. contrasted

Table 4 HAL for Small (<5 cm), Large (5 –10 cm), and Very Large (>10cm) Tumors	Tumors < 5 cm (n=32)	Tumors 5 - 10 cm (n=28)	Tumors > 10 cm (n=14)
OR Time (minutes)	216 ± 82	182 ± 66	226 ± 56
EBL (cc)	103 ± 140	152 ± 197	194 ± 160
Change in HCT	5.5 ± 3.6	4.1 ± 2.7	5.4 ± 0.6
PO Intake	1.7 ± 1.3	1.8 ± 1.1	1.8 ± 0.9
Parenteral Narcotics (mg MSO4)	37 ± 23	33 ± 26	35 ± 22
PO Narcotic (tablets)	6 ± 5.1	6.6 ± 6	5.5 ± 4.9
Length of Stay (days)	3.9 ± 1.6	4.0 ± 1.4	3.6 ± 0.9
Complications (%)	4 (12.5%)	3 (11%)	2 (14%)
-Major	3	2	1
-Minor	1	1	1
Convalescence	< 1 month	< 1 month	< 1 month

their data to a contemporary series of 12 open partial nephrectomies and concluded that HAL provides effective tumor removal and excellent patient convalescence.

A theoretical advantage of HAL is the ability to manage larger specimens safely and reproducibly. The hand in the operative field allows for excellent retraction and maneuverability of larger specimens. This may not be as easily accomplished utilizing standard laparoscopic techniques. In addition, the larger lesions occupying the retroperitoneal space may limit surgeons utilizing a retroperitoneal approach. To examine this benefit, we separated our last 74 radical nephrectomies into three groups: Patients with lesions <5 cm (standard lesions), 5 to 10 cm (large lesions), and >10 cm (very large lesions).

Patient outcomes are compared between these three groups in Table 4. No statistical differences are noted in terms of operative time and, postoperative or convalescence outcomes. As expected, those patients with larger lesions have specimens that weigh more and reveal higher pathologic staging. There was one positive margin in a patient whose final pathology revealed a sarcoma measuring 14 centimeters in diameter. Follow-up is relatively short: 10 months in patients with standard and large lesions and 7 months in those with very large lesions. At time of follow-up, there was one distant recurrence in the standard lesion group and one local recurrence in the very large lesion group. The local recurrence occured in a patient with renal sarcoma. These data support the perception that hand-assisted laparoscopy provides a safe,

reproducible, and minimally invasive technique to remove large (> 5 cm) and very large (>10 cm) renal tumors.

Results concerning HAL-dismembered pyeloplasties are limited. We have only performed 4 to date, and there are no published reports in the literature. Of the 4 we performed, all patients had a preoperative, 3D-reconstructed magnetic resonance imaging including MR angiography and MR urography. In addition, a MAG3 nuclear scan with lasix washout confirmed obstruction. For each, HAL was used to perform a dismembered pyeloplasty as described above without complication. On follow-up nuclear scan and/or IVP, all patients showed no evidence of obstruction.

Conclusion

Hand-assisted laparoscopy is a safe, reproducible, and minimally invasive technique to perform extirpative renal surgery. There are clear advantages over traditional open surgery including decreased blood loss, pain medication requirement, hospital stay, and convalescence. HAL does not appear to compromise any of the oncological principles of open surgery. Compared with standard laparoscopic techniques HAL may be better in certain instances, including donor nephrectomies, nephroureterectomies, and the removal of very large specimens. Though originally evaluated for extirpative surgery, HAL is beginning to be utilized as a minimally invasive technique to perform complex reconstructive urologic surgery. The exact role and best use of hand-assisted

laparoscopy in urology will require larger randomized studies with longer follow-up. ∎

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Main Points

- Hand-assisted laparoscopy (HAL) mirrors standard transperitoneal laparoscopy, with the advantage of the hand in the operative field.
- A choice of 3 effective devices is available, depending on surgeon preference, location of hand incision, body habitus, and history of abdominal surgery.
- HAL is a safe, reproducible, and minimally invasive technique for extirpative renal surgery.
- In donor nephrectomies, nephroureterectomies, and removal of very large specimens, HAL may be better than standard laparoscopy.
- It is increasingly being used in complex reconstructive surgery.
- Its exact role and best use are still being investigated.